MEETING SUMMARY
PROTOCOL PANEL
ETV SMALL SYSTEMS PILOT
ANN ARBOR, MI
JULY 22, 1996

I. Meeting Introduction and overview of EPA Environmental Technology Verification Program (Bruce Bartley, NSF *International*)

The goal of this program is to organize, develop and pilot a program for verification testing of package drinking water treatment systems for use by small communities. The expected result is the establishment of a self-sustaining performance verification program through user fees, data sharing, and issuance of joint EPA/NSF statements of performance verification. "The Program" is part of the U.S. EPA's Environmental Technology Initiative's (ETI) Environmental Technology Verification Program (ETV). The program hopes to accelerate the use of environmental treatment technology in the USA and internationally. "The program" is one of four verification pilots in the Office of Research and Development's (ORD) ETV program.

The program result will be the **verification** of a technology's performance under specific conditions, following predetermined test protocols. This is **not** an NSF certification program. The key activities of the program include: 1) forming a steering committee to advise NSF and EPA on the pilot program's activities, 2) Develop test protocols to assure quality data regardless of testing organization, 3) Testing to verify performance of treatment technologies, and 4) Establish a self-sustaining performance verification program.

The purpose of the Steering Committee is to direct the technical aspects of the program. The committee consists of 5 state representatives, 5 equipment vendor reps, 2 engineering firm reps, 2 EPA reps, and 2 small community reps. The purpose of the Protocol Panel is to develop the test protocol(s) recommended by the Steering Committee. The Panel is made up of scientists and engineers from testing organizations, academia, equipment manufacturers, EPA, and states.

Steps for Test Protocol Development include: 1) Research and drafting of protocol, 2) protocol panel reviews and recommends changes to the draft protocol, 3) Draft test protocol is revised, and final draft is forwarded to Steering Committee, 4) Steering committee reviews final draft test protocol, and either requests changes or recommends EPA and NSF approval, 5) States review and recommend changes to protocol, and 6) The final test protocol is distributed by NSF and EPA.

The steps for Product Performance Testing include 1) Equipment vendor(s) apply for testing according to EPA/NSF protocol, 2) Select field site that appropriately challenges equipment, 3) Use testing organization accepted by EPA and NSF, 4) Data collection with QA/QC auditing done by NSF throughout test, according to protocol, 5) Draft test report prepared by testing organization and reviewed by NSF, and 6) Final test

report on equipment performance issued jointly by EPA and NSF.

II. The Protocol Panel's discussion on (and review of) *The Protocol For Equipment Verification Testing For Physical Removal of Microbiological and Particulate Contaminants*

Jim Bell asked how the representation on the steering committee was determined. Bruce Bartley explained that the representation on the steering committee was designed to maximize the involvement of the "key" groups (state and vendors, with user involvement considered less important). Jeff Adams commented that the Steering Committee was flexible, and may pick up additional members in the future if the need arises. Bruce Bartley agreed, and admitted that some sectors were not represented. He said he could foresee the addition of an international representative.

Addressing the *Protocol for Equipment Verification Testing...* , Bruce stressed that all three of the distributed documents (*The Protocol For Equipment Verification Testing For Physical Removal of Microbiological and Particulate Contaminants* ; *The Equipment Verification Testing Plan for Membrane Filtration; and The Equipment Verification Plan for Coagulation and Filtration)* went together, with the protocol serving as the framework for the two testing plans. He then asked for comments. Jim Bell asked how other test data (from academia, other organizations, etc.) would tie in with this program. Bruce Bartley said that it wouldn't. Bob McCarthy commented that NSF didn't have the right to say that all other test data was insufficient. Jeff Adams said that this issue would be discussed the following day in the steering committee meeting. He stated that the rationalization behind their reasoning was that NSF/EPA wanted to give states a common test, but that manufacturers could still go to states with their own test results, they just wouldn't bear the NSF name. Joe Jacangelo stated that he thought perhaps data from the protocol could be combined with existing data to support verification.

John Dyson wanted to know how many states would accept this protocol. Ira Gabin commented that many states were already using other NSF standards, and that this was a good sign that they would also accept this protocol. He claimed it would be a benefit to the manufacturer to get involved in this program. Jeff Adams stated that this protocol would benefit the states and manufacturers by reducing the number of pilot studies needed, but that the level of state acceptance could not be determined at this point. He then stated that this issue would be discussed in the steering committee.

Raymond Thursby asked if before they went back to discussing protocol, if they could address the international aspects of the protocol acceptance. Bruce Bartley stated that NSF was moving toward an international perspective in all aspects of its operations, and that they had recently signed an agreement with the World Health Headquarters.

Bob McCarthy said that he thought operating costs and long term viability should

be of *primary* concern to states, and that the protocol should reflect this. Bruce Bartley asked if the protocol needed to capture cost, operating issues, and reliability. Jeff Adams suggested that the language be beefed up to stress reliability more. Bob McCarthy agreed with both of them.

Roddy Tempest stated that at some point the operator & state needs to know the cost and difficulty of obtaining the next level of treatment. Bob McCarthy stated that one of the first steps should be a claim made by the manufacturer on the operating cost of his equipment. He also commented that the protocol should emphasize automatic/manual operation, and how many hours per week of attendance a system requires.

Gary Logsdon asked if that wasn't stated in the protocol. Bob McCarthy agreed that it was, but the protocol gave no methods for measuring or quantifying it. Jeff Adams asked if the language in the protocol should be changed. Bob McCarthy decided that language did not need to be changed, but that this issue could be addressed in individual test plans.

Bridget O'grady agreed that it was important to switch cost efficiency to a primary concern in the protocol. Bob McCarthy said you're going to have to go to operational plants and find out how much they're costing. Roddy Tempest claimed that was too qualitative on operator's experiences, varying conditions, etc. He also said they needed a measurement transferable between systems, something that would allow users to compare "apples and apples".

Richard Sakaji asked if there were any way to compare, on an equivalent basis, the efficiency of plants which utilized different technologies. He cited power consumption as a possible example.

John Dyson commented that power consumption is highly dependent on plant design and varying water conditions, and that these variables, along with operating hours, were hard to pin down.

Bob McCarthy stated that there are a countless number of small towns with out enough money to filter water. These towns can not afford to do pilot studies, and these costs need to be addressed. John Dyson reiterated that there are too many variables involved in the treatment process, and that these costs can not be pinned down. Roddy Tempest argued that the program needs some kinds of rating system for costs, which explained the cost discrepancies between different operating and maintenance situations. Bob McCarthy stated that the manufacturer needs to make a claim about the reliability and cost of his technology, and that there needs to be some way to test/quantify this.

Gary Logsdon replied that they had tried to develop a cost rating system in his studies, but that there were too many variables which were incomparable and subjective.

Roddy Tempest expressed that perhaps operating and maintenance costs could be included into test protocol in such a format that would allow users to compare different systems.

Bridget O'Grady declared that perhaps this was an issue that could be resolved during the present reauthorization of the Safe Drinking Water Act, as the intent is toward standardization. She said there was a good probability that the EPA would develop guidelines which would eliminate this problem, as well as determine what class/level of operator a system requires.

(Short Break)

Bruce Bartley reconvened the meeting.

Gary Logsdon commented that this program will help clarify the advantages of a particular package plant. Bob McCarthy responded that when the NSF mark is on a statement that says his product is better than another, NSF could get themselves into trouble. Jeff Adams replied that this would not be the case, as the manufacturers' performance statement/claim would be verified by NSF, the testing agency, and the EPA, and would not be directed at the consumer. Donna Cirolia responded that the performance statement would say if the product is good at doing or not so good at doing some type of treatment.

Philip Olson asked what was meant by the reference to "alternative technologies". Gary Logsdon defined it as anything besides coagulation or membrane filtration when dealing with surface water. Bob McCarthy commented that as a system, package plants were <u>all</u> considered alternative technologies. Philip Olson asked if the term was dependent upon where the unit was assembled, and why package plants were considered alternative technology when they used the same technology as other treatment methods. Gary Logsdon expressed that it didn't matter how the plants were defined, only how they were tested.

Philip Olson asked how they were going to establish a protocol given all the variables present in different technologies, and went on to question how this protocol would be used to test brand new technologies Gary Logsdon replied that they would have to find a similar process in the protocol and then design a test plan around it, unless the technology was completely different, in which case they'd have to use a different protocol. Bruce Bartley stated that when new technologies were still in the R&D phase they would not be covered under the protocol. He went on to explain that while this protocol is not for use with prototype technologies, it may help companies' R&D programs to test their prototypes.

Joe Jacangelo stated that cryptosporidium testing was optional in the protocol because the current methods were less than reliable. Gary Logsdon added that some

professionals think that the raw and treated water method of testing for crypto is so bad, it's not worth doing. He emphasized that this opinion came from people who earned their living at it, and went on to point out that the ASTM had discontinued a crypto testing method because it was so bad. William Kelley expressed that crypto testing should be included in the protocol only after an acceptable testing method is discovered, and voiced that at this point its inclusion could be deceiving. Jeff Adams commented that crypto testing could still be beneficial. Joe Jacangelo agreed that it was good to keep crypto testing in the protocol, as long as it was optional. Bruce Bartley stated that they didn't want to preclude anybody's claim.

Donna Cirolia asked if it were possible to use any tests from the NSF/ANSI standard 53 on latex spheres for cyst reduction. Gary Logsdon replied that due to crypto's flexible nature, it would be necessary to guarantee a pore size of 2-3 microns. He recommended that latex bead tests be used.

Bruce Bartley postponed discussion on this topic until the following day.

Jim Bell asked whether or not the tests had to verify the manufacturers' claims. Bob McCarthy explained that the manufacturer does not make a pass/fail claim, but that the manufacturer can make any claim desired, and then NSF verifies the actual level at which the plant performed.

Roddy Tempest pointed out that pg.9 was cut off, and then asked if a different protocol would be used for the actual destruction of crypto. Bruce Bartley confirmed that it would. William Kelley voiced his disbelief that NSF would put their name on a claim that stated x % crypto removal, when this method was proved faulty. Jeff Adams replied that he was confusing verification and certification. Bruce Bartley reiterated that the program did not want to preclude the situation where a state requires that package plants do crypto filtration studies.

Joe Jacangelo commented that if he were a manufacturer he would not do crypto testing, but would simply rely on pore size distribution and testing. Roddy Tempest voiced his disbelief that pore size distribution data would be sufficient to assure a community to be free of crypto. Joe Jacangelo stated that it would be sufficient.

Philip Olson commented that most package plants are subject to a cycle, and therefore pore size doesn't guarantee anything, as sudden flows at cycle start-up allow a lot of particles to flush through the membrane. Joe Jacangelo asked if intermittent flow changed water quality. Philip Olson confirmed that indeed it did, and to a large degree.

Jane Stephenson stated that it was impossible to guarantee the size of crypto since it's a biological organism, and that the pore size test would not be valid. Roddy Tempest inquired whether the protocol tested the parameters for effluent flow, or what happens on

a 24 hour cycle, as the first "blast" upon start-up has much higher contaminant concentrations. Stephen Baker confirmed that this was included in the test, and referred him to line 17.

Bruce Bartley asked if there were any suggestions for language change. Roddy Tempest said he'd read back through the protocol and send Bruce any suggestions.

Bruce Bartley suggested that the panel discuss the qualifications for a sample collector. Gary Logsdon commented that the most important qualification for a collector should be that he participate in the QA/QC program. Stephen Baker suggested that the protocol define "technical person", "field supervisor", "alternative technology", and "package plant", along with any other non-descript terms.

Bob McCarthy asked if state labs pursued ISO certification. Bruce Bartley replied that it didn't occur very often.

Jim Bell asked what was meant by an "NSF qualified testing organization", as referred to on pg.15, line 22. Bruce Bartley explained that these are labs/organizations with one or more of the following qualifications:

(1) TEST LABS
- -State certified
- -ISO/EN certified
- -ICR labs
- -Labs that have undergone NSF audit

(2) TEST ORGANIZATIONS
- -Professional Engineers
- -Experience capabilities in drinking water or small systems

John Dyson asked who would oversee the testing organization. Joe Jacangelo responded that the manufacturer would pick a testing organization they are comfortable with. Jim Bell inquired whether or not NSF had a list of qualifications for a lab to be deemed "acceptable", and whether NSF has a current program to certify testing organizations. Tom Stevens replied that NSF does have a current program for certifying "Alternative NSF labs", and that while this program will be similar to determining qualified testing organizations as cited in the protocol, they will not be the same. Bob McCarthy asked how much NSF was going to charge labs to become certified. Tom Stevens replied that it could not be determined at this point.

(Lunch Break)

At this point in the meeting, issues on which discussion has been postponed to the Steering Committee include:

1) Program benefits to manufacturers
2) Acceptance policy for existing ("grandfather") test data
3) International aspects of program
4) Cryptosporidium testing

Bruce Bartley opened discussion on the membrane filtration test protocol, stating that both test protocols had already been read by academic peer reviewers.

Joe Jacangelo addressed the issue of testing system integrity and, referring to page 13 of the test protocol, raised the questions of whether or not the sonic testing method of membrane integrity was quantitative, and if it could be done on line in the system. Bob McCarthy commented that only after a system's "non-intactness" had been established, could sonic testing be used to determine which part had failed. He then went on to explain this process. Joe Jacangelo commented that some manufacturers use sonic testing on line to find leaks in a system. Ira Gabin voiced his concern that sonic testing didn't seem as reliable as the first two integrity tests cited in the protocol. He felt it would be more acceptable if there was a more reliable way to gauge it other than the human ear. Joe Jacangelo expressed that particle counting could be utilized as an integrity test.

Bob McCarthy explained that integrity testing was a quantitative method of validating the integrity of a membrane, whereas particle counting and turbidity were methods to verify quality control. He stressed that particle counting could not serve as an integrity test. Joe Jacangelo stated that because particle counting accurately represents what's passing through a membrane, it gives a good indication of a membrane's integrity. William Kelley disagreed, explaining that particle counting is too sensitive to fluctuations in raw water quality. He stated that his tests had shown that the accepted integrity testing methods were the only way to determine membrane failure.

Gary Logsdon proposed that a sentence be added to the protocol which stated that a "true" integrity test be done if membrane integrity was questionable.

Bob McCarthy expressed his desire that task five be labeled "Water Quality Assurance" and broken into two sub-categories: "Water Quality Analysis" and "Membrane Integrity Testing". He stated that this was necessary in order to hold true to the definition of integrity testing.

Joe Jacangelo, addressing the issue of TOC and virus testing, stated that it would be useful to determine the amount of TOC removed, and pointed out that this and virus removal were optional tasks in the protocol. He then addressed the issue of membrane pore size distribution, stating that because pore size determines the size of removed particles, it is an adequate method to insure crypto removal. He also stressed the importance of establishing an acceptable, standard method for determining the pore size

distribution.

Bob McCarthy commented that a high pressure, diffusive air flow test is sometimes used to indicate pore size distribution, but that it too is a highly controversial method. He pointed out that the cost to analyze the data from a latex bead test would be phenomenally expensive.

Joe Jacangelo agreed that there is no consensus in the scientific community as to which test gives the best pore size distribution results. He suggested that the protocol include a method for determining the maximum pore size instead. Bob McCarthy stated that maximum pore size testing was more accurate and less costly than pore size distribution testing. He expressed his opinion that NSF should accept a manufacturer's word on the maximum pore size in their system. Joe Jacangelo disagreed, explaining that they can not accept a first party's word on that.

Bob McCarthy argued that he was not going to pay large amounts of money for NSF to determine his pore size using the latex bead method. Joe Jacangelo explained that manufacturers did not have to use the latex bead method; that they could use any method which had been approved by NSF.

Jim Bell commented that the point of the discussion was to determine if pore size distribution will provide crypto removal within a certain confidence level. Bob McCarthy claimed that the proposed methodology for determining pore size distribution would be "highly controversial and extremely expensive". Jeff Adams proposed that the panel obtain some feed back from the scientific community on this topic, and then resume discussion at a future meeting.

Jane Stephenson suggested that on pg. 21, line 32, after the maximum sample shipping time, a maximum time before sample testing should be added. She also suggested that the panel consider including a test for ATP.

Joe Jacangelo, referring to table two, questioned whether or not this testing period was too short, and suggested the protocol might need as much as three weeks of testing for each membrane variable. Jeff Adams pointed out that the protocol referred to the minimum testing time required. Joe Jacangelo voiced his concern that a month may still be too short, even for a minimum.

John Dyson stated that the testing duration would depend in large part on the raw water consistency. Bob McCarthy suggested that it might be appropriate to have periods of more intensive data gathering.

Joe Jacangelo asked what effect test duration had on cost. Bob McCarthy responded that once you were testing, it made more sense financially to stay there and

continue testing, rather than to break it up into different periods. William Kelley also voiced his concern that breaking up the testing did not give accurate results on membrane cleaning efficiency.

Joe Jacangelo raised the question whether testing should be done four months straight, or whether seasonal variation was the key. He commented that while seasonal data generates information as to how often cleaning should occur during different seasons, it would take about a year for manufacturers to achieve optimization, and that this was not our goal.

Bob McCarthy stated that state licensors will want to know how the plant works, if it breaks, can it treat hot or cold, dirty or clean water? In order to get all this information, it is necessary to run the test for a year.

Richard Sakaji asked if the plants were going to be tested in an existing system. Bruce Bartley responded that yes, they would be.

Richard Sakaji clarified that there were two testing options: an intense four month test, or a one year test with four intense testing periods.

Raymond Thursby asked whether a manufacturer could translate test data between different models which utilized the same technology. Joe Jacangelo responded that he thought that would be possible. Gary Logsdon added that it could be easily done if two models shared the same engineering parameters.

Roddy Tempest suggested that operating and maintenance software packages be utilized to make data interpretation easier, and stated that he knew of specific programs he could recommend.

Joe Jacangelo asked for and received a consensus for a year long testing program with four "intense" data gathering periods, interspersed by "passive" periods. Gary Logsdon recommended that the operator run the plant during the passive periods, unless the plant was self-automated.

Jim Bell wanted to know how that would work on a pilot plant, and if an operator would have to be subcontracted during the passive periods. Bob McCarthy expressed that the community should collect the passive data, because they were the ones who wanted the plant approved. John Dyson voiced his concern that there could be inaccurate data due to operator error.

Donna Cirolia suggested that the states comment on what type of testing period they would approve of. Philip Olson responded that a year's worth of data was required to gather sufficient seasonal impact information. Richard Sakaji suggested that the limits

of the tests be extended multiple times until failure to ensure that operating and design paramters can be met reliably. He also commented that manufacturers should test the systems during their most vulnerable periods, such as during low transmittance for UV disinfection systems, or during filter ripening for filtration systems. Bob McCarthy agreed, stating that from a commercial standpoint it was a good idea to push the plants to their limits.

Philip Olson asked whether that "limit" would then become the manufacturers' claim. Bob McCarthy thought that the claim should reflect whatever level the plant performed at just before failure. Joe Jacangelo clarified that the performance claim was made to NSF, and not to the consumers. He then asked that the panel hand in any changes to be made to the membrane test protocol.

Bruce Bartley asked if any cost figures were available yet. Joe Jacangelo responded that while there were no figures available for the protocol's current form, the range for the old form was roughly estimated to fall between $50,000 and $200,000 depending on whether there were extensive microorganism claims such as viral removal. He explained that a large portion of those figures represented labor costs, which could be reduced in the options that had just been discussed.

Bob McCarthy inquired about the necessity of having an engineer on site, stating that the data could be monitored from remote via a modem. William Kelley commented that would only be applicable to some plants. Jeff Adams inquired about the advantage of having a professional engineer on site daily versus weekly. Joe Jacangelo responded that an engineer can interpret data and make changes, while an operator only records data.

Bob McCarthy suggested that an engineer be on call daily, but not necessarily at the site. Jeff Adams acknowledged McCarthy's comment as a possibility, and stated that it was important to NSF and the vendors to find a site and operator set-up which would minimize costs.

Bob McCarthy asked how much money NSF was making through this program. Bruce Bartley explained that currently the program was a pass through cost to NSF, which would be funded by the EPA. He stated that this may change in the future as the program became more self-sufficient. Bartley then opened discussion on the Coagulation and Filtration test protocol.

Gary Logsdon stated that the testing frequency of 5 days/week might present problems because when the test was run 100 hours, it would run through a backwash cycle. John Dyson voiced his concern that to run only 5 days/week would incur more costs to the manufacturer due to an engineer's travel costs.

Jim Bell asked how many hours/week does the test run. Gary Logsdon explained

that it ran 100 hours/week, for a total of three weeks. John Dyson asked if it would be possible to run three weeks straight with no breaks, in order to reduce travel costs.

Gary Logsdon replied that it would be possible. He then went on to address the issue of utilizing a particle counter to assess particle removal. He stated that because the coagulation/filtration process changed the size/number of particles, particle counting was inaccurate in determining removal efficiency. He presented a diagram of the coagulation/filtration process to illustrate his point. Logsdon consented that particle counters could be used as on line sensors to determine a problem in a system.

Richard Sakaji asked if particle counting across the entire process train could be considered as conservative. Gary Logsdon responded that it could not, due to too many variables. He stated that it would have to be compared to particle counting not using coagulation. Richard Sakaji inquired as to whether the same problems would arise with micro organisms. Gary Logsdon said that these problems would not arise, as long as the micro organisms did not flocculate.

Jeff Adams asked if Logsdon could outline the approach for assessing micro removal. Gary Logsdon commented that it was first necessary to determine how many micro organisms lived through the coagulation/filtration process. He presented the removal data from a waterworks study which utilized coagulation, filtration, and then disinfection:

Organism	Removal
HEV	≥3.0 Log
Coliphage	≥3.0 Log
Clostridium	≥4.0 Log
Giardia	≥3.0 Log

Logsdon added that the removal rates between viruses and bacteria were very similar.

Bob McCarthy asked how the presented removal rates corresponded to particle counts. Gary Logsdon stated that particle counting was not done in that study. He then informed the panel that the article he referenced in the protocol (Allani et al) was published in ‘86, not ‘96. Stephen Baker suggested that Allani found particle counting to be a reliable method in his study. Gary Logsdon replied that the reliability depended on how the test was done.

Stephen Baker commented that he didn’t see any evidence for discounting particle counting, and wanted to see it remain in the protocol for testing the removal process. Gary Logsdon reiterated that he didn’t feel particle counting was accurate when flocculation was involved. Richard Sakaji asked how much error was represented in the removal numbers that Logsdon cited. Gary Logsdon replied that because he hadn’t seen

the lab data, he could not provide any error bars. Logsdon then addressed the issue of surrogate testing, and asked the states what their stance was on surrogates.

Richard Sakaji asked if non-culturable organisms were a interface that could pass through the process and are not enumerated because they cannot be cultured. Gary Logsdon replied that it was good to use coliforms. Richard Sakaji asked if on line particle counting would give better removal data than surrogate testing, and if there were any way to combine them. Jeff Adams said that they could be combined, because particle counting was optional. Richard Sakaji said that he would like to see particle counting be mandatory in the protocol.

Jim Bell asked how the program was going to address changes in technology. Bruce Bartley explained that the panel would have to use good judgement, as it would not be feasible to change the protocol every year.

Jim Bell suggested that because surrogates were a more recent technology, surrogate testing should be optional in the protocol, and particle counting should be mandatory. Stephen Baker admitted that both methods have advantages and disadvantages.

Jeff Adams suggested that surrogates were inexpensive, and should be required, along with particle counting. Bob McCarthy commented that it would be unwise for a manufacturer to not use particle counters, as there were obviously some states that wanted them. John Dyson consented that most states liked particle counters.

Gary Logsdon commented that particle counting was acceptable as long as its limits were acknowledged. He stated that when the states ask for a certain log removal, they are asking too much of the particle counting method. Donna Cirolia suggested that particle counting be mandated because it was more accepted.

Bruce Bartley opened the issue of operator concerns. William Kelley asked if the plants would function properly if they had to be operated manually. Gary Logsdon stated that there was nothing they could include in the program which would prevent against operator error. He added that four, three hundred hour tests would not answer any “ease of operation” questions.

William Kelley suggested that often times it is necessary to operate a plant manually, and that this be addressed in the protocol. Jeff Adams replied that the protocol could not quantify or verify that situation, but that perhaps the manufacturer should make some statement regarding a plant’s ease of operation.

William Kelley responded that the competency required of an operator is highly dependent on the consistency of the raw water. Jane Stephenson suggested that the

manufacturer determine what training was required to operate a plant, and then test an operator against that requirement. Bridget O'Grady responded that they can only educate an operator to a certain point, after which he is the municipalities's responsibility and not the manufacturer's. William Kelley emphasized his concern regarding a plant's manual operation. He stated that there were only a few minutes lag time for an operator to take over a plant upon automated failure.

Stephen Baker stated that automation should be a back-up to the operator, and not the other way around. Gary Logsdon commented that the operator's role was to determine what levels were needed and then set the controls. Stephen Baker stated that an operator was required to be certified. Bob McCarthy inquired about the number of certification levels. Stephen Baker replied that most states had four levels.

Jim Bell commented that the whole point of the verification program was to supply the states with information regarding a system. He then asked if it wouldn't be possible to assess the information in a verification report to determine the level of certification required of an operator. Stephen Baker replied that Bell's suggestion was possible, and added that coagulation and flocculation required a level two operator. Jim Bell clarified that the verification report needed only to explain an operator's function, and then states could determine the certification level required. Stephen Baker agreed that this was correct.

Bruce Bartley addressed the issue of cost. Gary Logsdon stated that the coagulation/filtration test would run about $20,000 per 4 weeks, and the lab work would cost about $4,000. He added that there were other ways to arrange the work to reduce costs. Bruce Bartley suggested that the vendor and testing organization should negotiate what's reasonable.

Gary Logsdon added that site selection would also have a large impact on cost. Bob McCarthy asked the panel that while doing cost analysis, to keep in mind that the manufacturer will spend over $100,000 on equipment depreciation, instrumentation, and other costs. John Dyson commented that it still might be necessary for the manufacturer to use multiple sites in order to test different water conditions.

Gary Logsdon added that there were lots of creative ways to "broaden the gaps", such as using multiple sites and locating tests next to an engineering firm, to name a few. John Dyson responded that it was difficult for a manufacturer to find different sites with water that matched their testing needs. He added that the cost escalated with the number of sites.

Bob McCarthy asked if NSF could verify other labs to run pilot plants. Bruce Bartley replied that this issue would be addressed the following day, and then asked for any closing comments.

Stephen Baker asked what size ranges would be required on particle counters. Joe Jacangelo responded that normal bin sizes would be used. Stephen Baker suggested that this be stated in the protocol.

Bruce Bartley explained that the next steps for the protocol development were:

1) Submit comments/changes on protocol by July 29, 1996
2) Rewrite protocol, panel review of revisions
3) Steering committee review of protocol

He then commented that the panel should discuss any new issues by phone, and that any recommendations for new steering committee members should be submitted to him.

Jim Bell stated that he counted 25 people on the steering committee list. Bruce Bartley explained that not all of these people were voting members, and said that he would fax out a new list which specified who had a vote.

Note: No new topics have been added to the parking lot since the lunch break.

MEETING ADJOURNED